FINAL SUBMITTAL

EXECUTIVE SUMMARY

FEASIBILITY STUDY FOR EXPANSION OF ENERGY MONITORING AND CONTROL SYSTEM (EMCS) FORT DRUM, NEW YORK

Prepared for

NORFOLK DISTRICT
CORPS OF ENGINEERS, CENAO-EN-MC
803 FRONT STREET, NORFOLK, VIRGINIA 23510

Under

U.S. ARMY ENGINEER DISTRICT, MOBILE
INDEFINITE DELIVERY A-E CONTRACT
CONTRACT NO. DACA01-94-D-0033
DELIVERY ORDER NO. 0006

ENGINEERS, INC.

DENVER, COLORADO
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By

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EXECUTIVE SUMMARY

OBJECTIVE

This Energy Monitoring and Control System Feasibility Study was conducted for the Norfolk District, Corps of Engineers. Its purpose was to determine the energy conservation and economic benefits of a base-wide Energy Monitoring and Control System (EMCS) to control building mechanical and electrical systems at Fort Drum.

ALTERNATIVES

A total of 115 buildings were analyzed to determine the economic benefits of EMCS monitoring and control. Three alternatives were evaluated for Fort Drum:

- Alternative 1: Expand the Trane Tracer 100 EMCS to the buildings by adding more TRANE hardware and dial-up telephone lines to these buildings, and programming the data base and control sequences. The system would include the original 16 buildings plus any new buildings which were economically justified. The disadvantage to Alternative 1 is that the Trane Trace 100 EMCS technology is becoming obsolete. Also, the expansion of this system would have to be sole-sourced, which would increase the system cost. The additional cost for sole-sourcing is not predictable; therefore, it is not included in this analysis.

- Alternative 2: Install a new EMCS in parallel with the existing Trane Tracer 100 EMCS, thus ending up with two EMCS both operating over dial-up telephone lines. This would require installing a new central workstation and new field panels to the new buildings, telephone lines in the new buildings, and programming the data base and control sequences. The disadvantage to Alternative 2 would be maintaining two EMCS.

- Alternative 3: Install a new EMCS in place of the existing Trane Tracer 100 EMCS, plus add the new buildings. The new EMCS would utilize dial-up telephone line data transmission media (DTM), and would incur the costs of installing a new central workstation and new field panels in the new buildings and in the buildings with the Trane Tracer hardware. The disadvantage to Alternative 3 is the high cost, which thereby eliminates many buildings from inclusion in the EMCS. The advantage to alternative 3 is that the system would use the latest technology. Also, there would be an advantage in maintaining a single EMCS system.

METHODOLOGY

For each of the 115 buildings, implementation costs, energy savings, and manpower cost avoidance were determined for each heating, ventilation, and air-conditioning (HVAC) system, for each energy management function. Any energy management function which had a poor simple payback was dropped from the project. The remaining implementation costs and energy savings were summarized and the buildings were ranked in order of priority according to the savings-to-investment ration (SIR) of each. A project life cycle cost analysis (LCCA) was then performed for the three alternatives.

EMCS OPERATIONS AND MAINTENANCE

It is recommended Fort Drum add two EMCS operators, more formally classified as "utility systems controllers," to operate and manage the additional buildings included in this expansion project.

Correct and continuing maintenance of EMCS equipment is essential if the maximum benefits of the system are to be realized. It is recommended that this equipment be maintained and calibrated under a maintenance contract by a manufacturer's service representative. The costs for additional system operators and a maintenance contract were included in the economic evaluation of the project.

CONCLUSIONS

- Of the 115 buildings evaluated, 110 buildings would provide an SIR greater than 1.0, if included in the EMCS, under Alternatives 2 or 3.

- The estimated construction cost for Alternative 3, to include the new buildings and upgrade the existing buildings was $3,335,539, only $521,041 more than Alternative 2.

- Including those HVAC and utility systems which have sufficient cost avoidance to justify connection to the EMCS, resulted in controlling and monitoring 4,931 points.

RECOMMENDATIONS

- It is recommended that an Energy Conservation Investment Program (ECIP) project be developed to provide a new EMCS at Fort Drum to control and monitor systems in 99 buildings without an existing control system, as evaluated in this study, plus replace the existing hardware in the 16 buildings connected to the existing Tracer system.

Alternative 3 would allow Fort Drum to have a single EMCS. The benefits of having a single EMCS are in the operation and maintenance of one EMCS, instead of two parallel EMCS. The EMCS should consist of new PC-based front-end computers communicating to building Remote Control Units (RCUs), Auxiliary Control Units (ACUs), and Unitary Control Units (UCUs), to control and monitor 4,931 points.

- It is recommended that all data transmission media be FO cable. A new data transmission system, consisting of contractor-installed aerial and underground FO cable is recommended for all data communication needs to the 99 buildings without an existing control system, recommended for the EMCS. It is also recommended that the existing FO DTM in the 99 buildings without an existing control system.

  It is recommended that Fort Drum hire two additional EMCS operators for the EMCS.

FORT DRUM SUPPORT

To be cost effective, the EMCS will need strong support from Fort Drum. If it does not get this support, large sums of money may be spent on an EMCS which never meets the Fort Drum cost savings goals. The cost effectiveness of an EMCS depends on several factors, including the following:

- Proper training and motivation of operators to use a large, expensive EMCS.
- Coordination between EMCS operations and DEH personnel, contractors, and others, to reduce both wasted materials and labor, and duplication of effort.
- Basic training of shops personnel to assure their activities do not excessively hinder EMCS operations. Education will enable shops personnel to use the EMCS in their operation and maintenance (O&M) and utilities areas and thereby improve overall cost effectiveness.
- High priority of funding for EMCS maintenance in order to keep the system in good operating condition.
- Obtaining a maintenance contract for EMCS hardware and software.
- Periodic verification and validation of energy and O&M cost savings to ensure that the EMCS is performing as planned.

If successfully implemented, the EMCS can assist all personnel in carrying out their missions. The EMCS can save energy, predict equipment failure, detect equipment failure quickly, and schedule preventive maintenance. Significant potential for cost avoidance exists at Fort Drum if EMCS

administration, operations, and maintenance activities are properly planned and implemented, and if the EMCS is used to its full capability. The existing system has proven that an EMCS will significantly lower utility costs for the Government.

TABLE ES-1
SYSTEM ECONOMICS

SYSTEM ECONOMICS	ALTERNATIVE 1 1995 $	ALTERNATIVE 2 1995 $	ALTERNATIVE 3 1995 $
Anticipated Contract Cost ($)	2,763,121	2,814,498	3,335,539
Total Investment, Per ECIP Guidance ($)	3,080,881	3,138,166	3,719,127
Annual Savings (MBtu)	182,855	182,855	182,855
First Year Energy Savings ($)	1,422,972	1,422,972	1,422,972
Annual Maintenance Manhours Savings ($)	56,820	56,820	56,820
Annual Electrical Demand Savings ($)	2,653	2,653	2,653
Annual Maintenance Cost ($)	(50,000)	(50,000)	(50,000)
Total Non-Energy Annual Recurring Savings ($)	6,820	6,820	6,820
Net First Year Savings ($)	1,429,792	1,429,272	1,429,272
Simple Payback (years)	2.15	2.19	2.60
Net Discounted Savings ($)	12,849,270	12,849,270	12,849,270
SIR	4.17	4.09	3.45

Table ES-2, starting on page ES-5, provides a summary of identical buildings which were grouped for the purpose of analysis.

Table ES-3 on page ES-6 summarizes the potential energy savings for Alternative 3. Column A of this table lists the savings for the building and systems analyzed in this feasibility study and recommended for connection to the EMCS for Alternative 3. Column B lists the energy usage incurred at Fort Drum in FY94. Column D lists the percent savings predicted for the EMCS, compared to FY94. Table ES-4 on page ES-6 provides similar information.

TABLE ES-2
SIMILAR BUILDINGS

GROUP NO.	BUILDING ANALYZED	BUILDINGS WITH SIMILAR CONSTRUCTION	BUILDING USE
1	36		Medical Center
2	1750	1240	Motor Repair Shop
3	2060	2050, 2072, 2074, 2070	Mnt Hangar Avum -Hangar Zone
4	2060		Mnt Hangar Avum -Ops Zone, 24-Hour Ops
5	2065		AF Ops building 24-Hr Ops
6	2065		AF Ops building Admin
7	4230		Mini-Mall w/ Gas
8	4305	10050	Physical Fitness Center
9	4530		SMA Building
10	10000		DIV CMD/CNTL Building
11	10205		Dental Clinic
12	10207	10502	Exchange/Club
13	10506		Clinic W/O Beds
14	10522	30, 173, 175, 4422, 4432, 4412, 4414, 10112, 10114, 10122, 10124, 10132, 10134, 10212, 10214, 10222, 10224, 10232, 10234, 10412, 10414, 10422, 10512, 10514, 10524, 10612, 10614, 10622, 10632, 10642, 10644	Adm & Supply, Enl Brk w/o Din-Admin
15	10522	30, 173, 175, 4412, 4414, 4422, 4432, 10112, 10114, 10122, 10124, 10132, 10134, 10212, 10214, 10222, 10224, 10232, 10234, 10412, 10414, 10422, 10512, 10514, 10524, 10612, 10614, 10622, 10632, 10642, 10644	Adm & Supply, Enl Brk w/o Din-Barrack
16	10550	30, 175, 4450, 10150, 10250, 10450, 10650	Enl Pers Din

TABLE ES-2
SIMILAR BUILDINGS
(Concluded)

GROUP NO.	BUILDING ANALYZED	BUILDINGS WITH SIMILAR CONSTRUCTION	BUILDING USE
17	10630	119, 174, 4400, 4410, 4420, 4430, 10100, 10110, 10120, 10130, 10200, 10210, 10220, 10230, 10400, 10410, 10420, 10500, 10510, 10520, 10610, 10620, 10640	Bn HQ Bldg
18	10670	4475, 4485, 4486, 10170, 10270, 10470, 10480, 10570, 10580, 10660, 10680	Veh Mnt Shop
19	10715		Post Safety/LEA 1st Floor
20	10715		Post Safety/LEA 2nd Floor
21	10730		Clo Sales/Retail/ Commissary
22	10745	4325, 4330, 10790, 10785	Child Support Center
23	10785	4405, 10030	Chapel/Rel Ed/ Child Care Cnt -RE/CC Zone
24	10785	4405, 10030	Chapel Zone
25	10785	4405, 10030	Chapel Offices Zone
26	11050		Clinic W/O Beds/ Supply/Incin-Non-Emergency
27	11050		Clinic W/O Beds/ Supply/Incin-Emergency
28	2060	2050, 2070, 2072, 2074	Mnt Hangar Avum-Ops Zone M-F 0600-1700

TABLE ES-3
ENERGY SAVINGS SUMMARY

	(A) ANNUAL SAVINGS	(B) CURRENT USAGE	(C) USAGE AFTER IMPLEMEN-TATION	(D) % SAVINGS (A)/(B)
Electricity (kWh)	15,618,500	97,210,000	81,591,500	16.07%
No. 2 Fuel Oil (MBtu)	26,627	327,432	300,805	8.13%
High Temperature Hot Water	102,697	518,556	415,859	19.80%
Totals (MBtu)	182,630	1,177,766	995,136	15.51%

TABLE ES-4
ENERGY COST SAVINGS SUMMARY

	(A) ANNUAL SAVINGS ($)	(B) ANNUAL CURRENT USAGE ($)	(C) % SAVINGS (A)/(B)
Electricity	854,331	5,317,387	16.07%
No. 2 Fuel Oil (MBtu)	113,271	1,392,896	8.13%
High Temperature Hot Water	452,894	2,286,832	19.80%
Totals	1,420,497	8,997,115	15.79%